



## **Environmental Measurements Laboratory Baseline Report**

**U. S. Department of Energy  
Office of Environmental Management  
Office of Science and Technology**



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## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	E-1
1 OVERVIEW OF THE LABORATORY .....	1-3
1.1 Introduction .....	1-3
1.1.1 History .....	1-3
1.1.2 Mission/Vision .....	1-4
1.1.3 Goals/Objectives .....	1-5
1.1.4 Strategies .....	1-5
1.2 Organization .....	1-7
1.2.1 Structure .....	1-7
1.2.2 Services Received from Other Organizations .....	1-9
1.2.3 Responsibility and Accountability .....	1-9
1.3 Core Capabilities .....	1-9
1.4 Summary of Major Business Areas .....	1-10
1.4.1 Quality Assurance .....	1-11
1.4.2 Environmental Measurements .....	1-11
1.4.3 Instrument Validation/Method Development .....	1-12
1.4.4 Emergency Response .....	1-13
1.4.5 National Security .....	1-13
1.5 Customers/Funding Sources .....	1-14
1.6 Facilities .....	1-16
1.7 Summary of Significant Accomplishments .....	1-17
2 STATUS REPORT .....	2-20
2.1 Management Oversight .....	2-20
2.1.1 Program Management .....	2-20
2.1.2 Budget and Accounting .....	2-20
2.1.3 Management/Technical Reviews .....	2-21
2.2 Status of Customers/Funding .....	2-22
2.2.1 Major Customer Funding .....	2-22
2.2.2 Work for Others and Service to Other DOE Offices .....	2-23
2.2.3 Partnerships and Collaborations .....	2-24
2.2.4 Technology Transfer and Deployment of Technology .....	2-24
2.2.5 Privatization .....	2-26
2.3 Status of Staffing .....	2-26
2.3.1 Demographics .....	2-26
2.3.2 Staffing Needs .....	2-27
2.3.3 Labor Relations .....	2-27
2.3.4 Other Workforce Issues .....	2-27
2.4 Operations Oversight .....	2-27
2.4.1 Capital Equipment .....	2-27
2.4.2 Infrastructure and Facility Maintenance/Needs .....	2-28

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2.4.3	Environment, Safety and Health (including Integrated Safety Management).....	2-29
2.4.4	Quality Assurance .....	2-29
2.4.5	Security .....	2-30
2.4.6	Information Management .....	2-30
2.4.7	Community Relations/Communications .....	2-30
3	APPENDICES .....	3-32

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## LIST OF FIGURES

Figure 1. EML's Organization. ....	1-8
Figure 2. EML Business Lines and Customers. ....	1-15
Figure 3. EML Funding: 1993-2001.....	2-22
Figure 4. EML's Technology Transfer and Technology Deployment Activities in 1999. ....	2-25
Figure 5. Staffing Profile for EML. ....	2-26
Figure 6. Age Distribution of EML Employees (1999 data).....	2-28
Figure 7. EML Capital Equipment Funding: 1993-1999.....	2-28
Figure 8. EML Facility Status.....	2-29

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## EXECUTIVE SUMMARY

The Environmental Measurements Laboratory (EML) is a government-owned, government-operated laboratory (GOGO) under the programmatic direction of the U.S. Department of Energy's (DOE) Office of Environmental Management (EM) and is administered through its Chicago Operations Office (CH). The laboratory is located in a General Services Administration (GSA) building in lower Manhattan, New York. EML, with its core strengths in monitoring, radiological measurements, and measurement technology innovations, provides value-added mission research and development (R&D) to DOE and several other federal agencies in a wide variety of programs, both nationally and internationally.

EML's current mission is threefold:

- Conduct scientific investigations and develop technologies related to environmental restoration, site and facility characterization, and environmental surveillance and monitoring
- Provide DOE and other federal agencies with an unbiased and responsive technical capability to assure quality in sampling, measurements and analyses, and risk assessment of human exposure to radioactivity and other energy-related pollutants
- Provide DOE and other federal agencies with an in-house, high quality scientific capability to address important issues related to national security such as nonproliferation.

As a federal R&D laboratory, EML provides its customers with expertise in program management, technical assistance, and data quality assurance for measurements of radiation and radioactivity relating to environmental restoration, global nuclear nonproliferation, and other priority issues for DOE and other government, national, and international organizations. EML's programs can be categorized into five major business areas:

- Quality Assurance
- Environmental Measurements
- Instrument Validation/Method Development
- Emergency Response
- National Security.

In addition EML provides technical expertise to the Characterization, Monitoring, and Sensor Technology (CMST) program and the Strategic Environmental Research and Development Program (SERDP). EML serves a broad range of federal customers, primarily in DOE, but also across other federal agencies that require applied research and operational capability in environmental measurement, quality assurance, and environmental applied research. EML's primary near-term strategy for fulfilling its mission and for increasing customer satisfaction and innovation will be to continue to meet the needs of its current customers, while also pursuing new customers. Its current federal customers include:

- DOE Office of Environmental Management (EM)
- DOE Office of Science (SC)

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- DOE Office of Nonproliferation and National Security (NN)
  - Work for Others (WFO) - Air Force (USAF), Defense Threat Reduction Agency (DTRA), Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC).

EML's Annual Business Plan establishes the near-term strategies and tactics that will help EML employees and stakeholders move the organization toward fulfilling its mission. The plan evaluates EML's current situation (market assessment), the external business and societal trends, and EML's primary competitors. It also addresses continuous improvement processes (primary strategies and performance metrics) and outlines EML Rewards Plan. It provides a financial summary and projections, as well as recent EML accomplishments and activities. EML conducts annual strategic planning retreats to review the previous year's Business Plan and plan strategies and performance metrics for the outyears.

EML's FY99 budget was \$7.550M. The FY00 Congressional Budget language indicated that:

*"EM's contribution to the EML in FY 2000 will be \$5,361,000. This level of funding will support the Federal work force of approximately 60 employees. However, the funding is not sufficient to support all of the administrative costs associated with the Laboratory. Work for others, such as (NN, SC, USAF, NRC) and other federal agencies will generate additional funding to be used for programmatic and administrative expenses incurred by this laboratory."*

EML has experienced a significant reduction in its funding from SC in the past and will experience an additional reduction (\$290K) in funding from NN in FY00. This decrease is partially offset by an increase in funding from EM; however, these funding issues make it difficult to support important programs without reprogramming.

As indicated in the Congressional language, there are no targeted funds for administrative activities [payroll, Integrated Safety Management (ISM) and quality assurance (QA), Nuclear Materials Accountability and Control (NMA&C), purchasing, safeguards and security (S&S), computing] at EML. In addition, capital equipment, facilities maintenance, and support contracting costs are not covered in the budget.

EML has a current federal employee ceiling of 66 full-time equivalents (FTEs), although the actual on board FTEs is 60. These FTEs are assigned to EML through CH. The scientific staff is composed of chemists, physicists, geologists, engineers, computer specialists, an ecologist, and a variety of technicians. Several key vacancies exist at EML. EML will need to continue to add staff to ensure that it maintains highly qualified staff in core competencies.

EML has requested \$500K in the FY01 budget for capital equipment. EML has had no funding for equipment since 1996. In order to maintain its reputation as a high quality laboratory, EML requires state-of-the-art equipment and scientific instrumentation to continue providing support to its customers.

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# 1 Overview of the Laboratory

## 1.1 Introduction

The Environmental Measurements Laboratory (EML) is a government-owned, government-operated laboratory (GOGO) administered by the Chicago Operations Office (CH). EML, with its core strengths in monitoring, radiological measurements, and measurement technology innovations, contributes value-added mission research and development (R&D) to the U.S. Department of Energy (DOE) and several other federal agencies in a wide variety of programs, both nationally and internationally. EML provides program management, technical assistance and data quality assurance for measurements of radiation and radioactivity relating to environmental restoration, global nuclear nonproliferation, and other priority issues.

### 1.1.1 History

EML traces its roots to the Medical Division of the Manhattan Project during and after World War II. The Division focused on industrial hygiene, radiation protection, and radiation safety. In 1946, when the Atomic Energy Commission (AEC) was established, the Lab was renamed the Health and Safety Division of the AEC. In 1953, it became the Health and Safety Laboratory, or HASL. Fallout from nuclear weapons tests became a major concern and the Lab's focus shifted to measurement and assessment of fallout using a network of gummed film monitoring stations and measurement of the radioactivity levels in various food products. In the 1950's and 1960's, the worldwide sampling network was expanded considerably to include soil and water samples, air filter samples at the surface and in the stratosphere, biological samples, and measurements of wet and dry fallout.

HASL acquired a reputation as the world leader in environmental radiation measurements, and the HASL Procedures Manual (HASL-300) became the standard for environmental radiation measurement techniques. In the 1960's, the Lab began making radon measurements in mines to assess the health risks of miners. In the 1970's, the Lab's worldwide sampling programs were expanded to include non-nuclear pollutants. When the AEC was crosswalked in 1975, HASL became part of the successor Energy Research and Development Administration (ERDA). In 1977, ERDA was absorbed into the newly formed DOE, and the HASL changed its name to the Environmental Measurements Laboratory.

In the 1970's, EML performed extensive radiation transport and dosimetry studies in and around nuclear facilities, and established the Quality Assessment Program (QAP) for environmental radioanalytical measurements and the environmental dosimetry intercomparison studies. EML did extensive dose reconstructions for nuclear weapons tests, and studied radon in homes. EML took immediate measurements after the Three-Mile Island and Chernobyl accidents, providing the ability to reconstruct accurately and comprehensively the environmental contamination resulting from these incidents.

In 1996, the Lab underwent a major change of focus when it changed its landlord from the DOE Office of Science (SC) (formerly Office of Energy Research [ER]) to the Office of Environmental Management (EM). Today, EML's primary focus is to support environmental monitoring, decommissioning, decontamination, and remediation efforts. EML continues to put

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its worldwide monitoring network to good use while developing instruments in support of nonproliferation activities. EML conducts in-situ measurements in support of many decontamination and decommissioning activities undertaken by DOE after the end of the Cold War. EML conducts neutron spectra measurements for bomb dosimetry, high altitude flight, and fusion research.

Over the past 30 years, EML has developed many technologies that have resulted in commercial success. In-Situ Gamma-Ray Spectrometry, the Guarded Metal-Oxide-Semiconductor Field-Effect-Transistor, Activated Carbon Radon Sampler, Wet/Dry Collector and the Pressurized Ionization Chamber total approximately \$184M in commercial sales. These technologies are used extensively at DOE sites as well as at other facilities around the world.

### **1.1.2 Mission/Vision**

EML's current mission is threefold:

- Conduct scientific investigations and develop technologies related to environmental restoration, site and facility characterization, and environmental surveillance and monitoring
- Provide DOE and other federal agencies with an unbiased and responsive technical capability to assure quality in sampling, measurements and analyses, and risk assessment of human exposure to radioactivity and other energy-related pollutants
- Provide DOE and other federal agencies with an in-house, high quality scientific capability to address important issues related to national security such as nonproliferation.

Through its leadership in environmental research and quality assurance, EML will continue to advance the mission of DOE and:

- Be recognized as a unique, internationally renowned environmental radiation and radioactivity measurements laboratory that, by integrating the physical and chemical sciences, conducts multidisciplinary investigations at local to global scales of current and anticipated concerns of the DOE and other federal agencies
- Function as an authoritative Quality Assurance (QA) Laboratory for DOE in management and execution of environmental radiation and radioactivity measurements, sampling and analysis
- Be recognized as an innovative developer of technology for measurements of environmental contaminants and physical phenomena and be an active promoter for the adoption of this technology by government and industry
- Represent an in-house federal center of scientific excellence for performing impartial assessments and critical reviews, providing technical guidance and training, and developing and deploying key technological advancements
- Attain excellence in the quality of all operations with special emphasis on environment, safety and health issues, establishing conditions that exceed basic compliance with all federal, state and local regulations.



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### 1.1.3 Goals/Objectives

Based upon the mission and vision of the Laboratory, the primary goals are:

- *Strategic Management Goal:* To be structured and have its technical programs oriented to take advantage of opportunities and contributions in the EM and CH strategic plans, their realignment goals, and the National Performance Review
- *Technical Project Execution Goal – QA, Environmental Measurements and Innovative Research and Technology:* To be recognized as a key federal resource in addressing critical issues in environmental measurements for DOE and other national interests. This includes strong technical, operational, and QA roles in field measurements for environmental contamination investigations, decontamination and decommissioning programs, emergency response, and matters relating to nuclear treaty monitoring. Innovative research and technology development will be required to maintain state-of-the-art skills. As part of this goal, EML will be recognized as a primary federal resource for expertise in QA for environmental radiation and radioactivity measurements in addressing critical issues of the DOE and other national and international organizations
- *Supportive and Safe EML Environment Goal:* To continue to maintain a safe employment environment and establish a supportive and rewarding work atmosphere that will attract, retain and motivate the staff to fulfill the scientific, technical, and administrative goals and responsibilities of the Laboratory
- *Administrative Goal:* To improve administrative efficiency to support the technical and scientific staff in fulfilling the Laboratory's mission in a timely and productive manner.

The goals, metrics, and accomplishments for each area are summarized in the EML 2000 Business Plan (Table 2) in Appendix A.

### 1.1.4 Strategies

#### *Strategic Management Goal*

In an era of shrinking budgets, EML's future challenge is to ensure sufficient funding not only to operate the institution but also to maintain its infrastructure especially for capital equipment and facility maintenance. The Strategic Management Goal is designed to meet this challenge. The strategies to accomplish the Strategic Management Goal are:

- Continue to meet the needs of its current customers, while also pursuing new customers
- Develop internal processes, including the utilization of teams, and external customer relationships that effectively integrate its programs and skills into DOE headquarters and field needs in environmental monitoring and QA
- Keep EML's business plan current and updated
- Modify the culture of the Laboratory through training and motivation to continually strive for increased efficiency and to accept change as a positive and constructive feature in EML's operations.

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*Technical Project Execution Goal - QA, Environmental Measurements and Innovative Research and Technology*

The capabilities of EML are not well known to large segments of EM (e.g., Offices of Site Closure and Project Completion) resulting in important potential customers overlooking EML as a useful, readily available, in-house capability. EML needs to improve the awareness of its expertise in QA technical areas, environmental measurements and innovative research and technology among current customers and with other potential federal customers where these needs exist.

In the event of a nuclear event that releases large quantities of radioactivity into the environment, it is in the best interest of the U.S. to have rapid and accurate data on levels and transport patterns of radioactivity at locations worldwide. Some geographical areas of the world are not adequately covered in EML's current environmental monitoring network, and some of EML's sampling sites have dated technology. In addition, EML's current capabilities in non-nuclear analytical measurements are not sufficient to address real-time measurements and other new innovative technologies that are emerging as high priorities in environmental characterization.

Strategies to improve EML's visibility and capabilities are:

- Position current EML staff and fill vacant personnel slots with staff able to improve the Laboratory's competencies in areas useful to existing and potential customers
- Improve the Laboratory's capabilities for performance verification of proposed field techniques or new in-situ sensors
- Expand participation in technical proposal reviews and other evaluations
- Provide appropriate EML personnel to aid/facilitate program management and/or overview of projects
- Develop and implement a plan to improve the image, visibility, and added value of EML's QA expertise to DOE and other national and international organizations
- Develop and implement a plan to identify, target, and develop EML's expertise and recognition in appropriate areas
- Include a funded research component in all QA programs
- Increase EML's participation in, and public relations about, demonstration projects, short-course training at universities and professional society meetings, workshops/conferences of professional and nonprofessional groups
- Convene a "platform team" to identify, target, and prepare an implementation plan to develop EML's expertise in areas useful to EML's current and potential customers
- Develop a plan to address more effective use of staff, cross training, transition to new job assignments, and alternate sources of personnel (e.g., graduate students, interns, contractors, etc.)
- Develop and implement a continuing, multi-agency targeted plan to ensure an awareness of the current nuclear threat to the world, and to find funding to maintain the efficiency of EML's global network to meet national needs.

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### *Supportive and Safe EML Environment Goal*

Changes in scientific programs and an increase in administrative requirements have caused the workload on scientists and support staff to increase and become uneven. The staff is not always aware of, nor do they recognize the advancement potential in, the opportunities to become experts in new or current technologies.

Strategies to improve this situation include:

- Use every opportunity to recognize and reward superior job performance, develop new skills through formal and on-the-job training, and investigate opportunities for advancement
- Develop a plan for reassignment and retraining of personnel that emphasizes new job assignments as a positive and ongoing feature of Laboratory operations and culture
- Keep staff informed of changes in administrative requirements, the needs of the Laboratory's customers, and the resulting need for changes in scientific directions and work assignments
- Encourage staff to enlist the support of mentors (internal and external to EML) to foster their development in promising areas of technology
- Encourage staff to provide suggestions/feedback on Laboratory operations and performance through supervisors, Division meetings, "open-door policies" and "Town Meetings."

### *Administrative Goal*

Work assignments and administrative duties must conform to the requirements of DOE and civil service directives from government agencies such as Office of Personnel Management (OPM) and Office of Management and Budget (OMB). EML is faced with "doing more" with reduced staff in a climate of shrinking resources. Strategies to address this issue are:

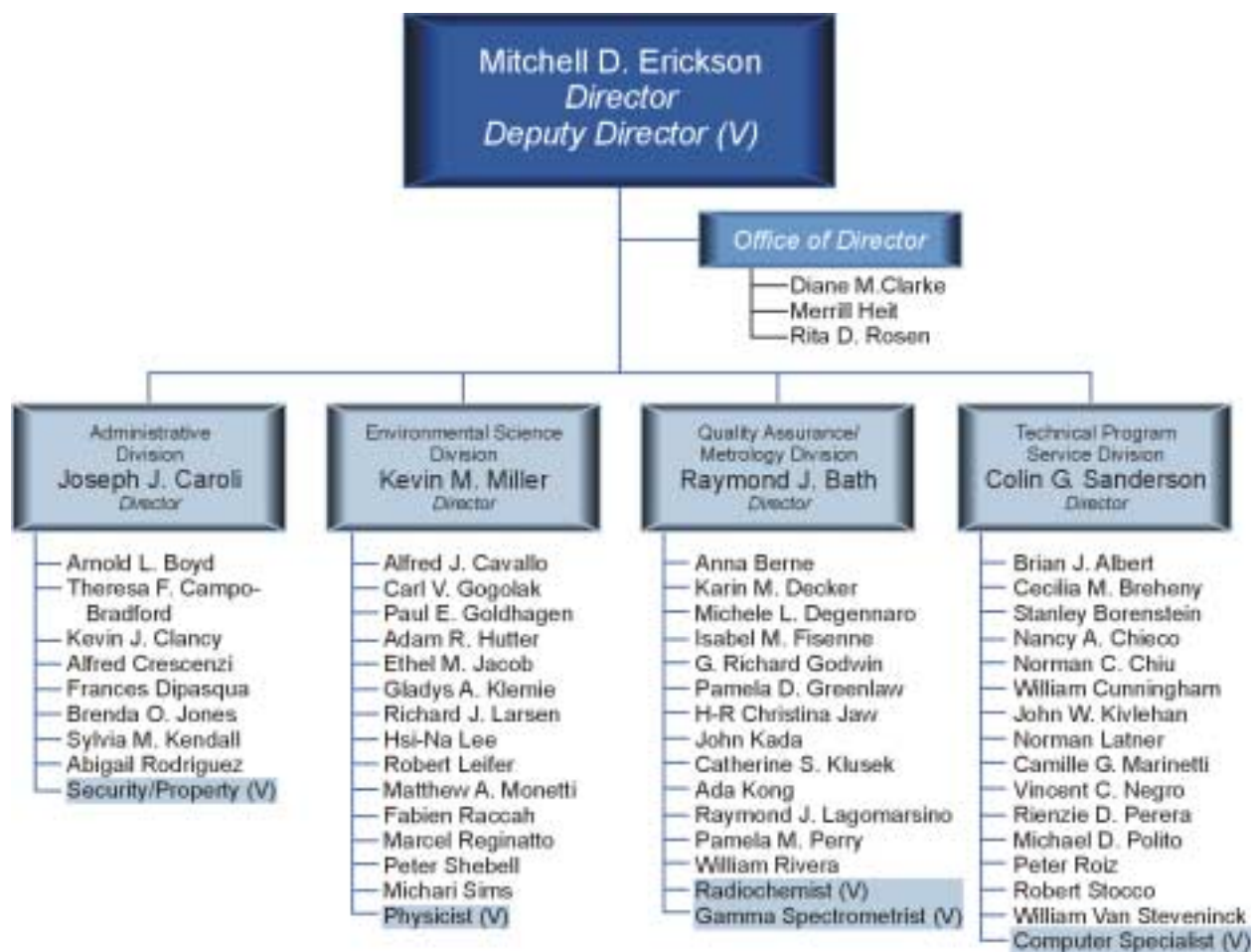
- Develop a plan to improve administrative efficiency that will include consideration of implementing new communications, and office automation technologies
- Develop a plan for reassignment and retraining of administrative personnel that emphasizes the evaluation of work assignments for increasing efficiency.

## **1.2 Organization**

### **1.2.1 Structure**

Figure 1 shows the structural organization of EML. EML's organization includes a Director's Office and four Divisions:

- QA/Metrology
- Environmental Science
- Technical Program Services
- Administrative.



**Figure 1. EML's Organization.**

These Divisions run discrete projects and possess primary customer responsibilities, but much of the project and applied research work takes place through cross-functional teams spanning the divisions.

The QA/Metrology Division (EMQ) directs EML's QA and analytical measurements programs. Expertise includes laboratory QA, analytical chemistry, radiometrology, and radiochemistry.

The Environmental Science Division (EME) provides expertise to support environmental management activities at DOE field offices. The division provides expertise in radionuclide pollutants in the environment, regional and global atmospheric transport modeling, subsurface transport modeling, atmospheric sampling, radiation monitoring, and statistical analysis of environmental data.

The Technical Program Services Division (EMT) provides expertise in remote systems and satellite communications, electronics design and engineering for laboratory and field instrumentation, and scientific software development for data acquisition.

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The Administrative Division (EMA) manages human resources, payroll, Environmental Safety and Health (ES&H) including Integrated Safety Management (ISM), Nuclear Materials Accountability and Control (NMA&C), purchasing, facilities management, accounting, library, and safeguards and security functions within EML.

### **1.2.2 Services Received from Other Organizations**

EML is largely self-sufficient. Guard, janitorial, and maintenance services are supplied through GSA. EML has service contracts for equipment and instruments, and contractor support for graphic arts. EML also provides or encourages its employees to participate in health-related activities such as annual physicals, the building's wellness center and public health nurse services, and the federal employee assistance program. EML relies on CH for human resources, legal, and patent services.

### **1.2.3 Responsibility and Accountability**

EML is under the programmatic direction of EM as the Cognizant Secretarial Office, and the Office of Science is EML's Lead Program Secretarial Officer. The laboratory is administered through CH and the Laboratory Director's supervisor is the CH Manager.

## **1.3 Core Capabilities**

Because of its expertise, EML has made valuable contributions to improving analytical measurements and reducing the risks associated with environmental cleanup and other issues facing the Department. These capabilities include:

- Aerosol Measurements
- Gamma-Ray Spectrometry
- Instrument Design and Fabrication
- Neutron Spectrometry
- Physical Modeling
- Program and Database Management
- Radiochemistry
- Radiological Surveys.

**Aerosol Measurements:** EML maintains a global network of air samplers that collect particles in the atmosphere. These samples are routinely measured at the laboratory for gamma-ray emitting radionuclides. In addition, new automated aerosol samplers are being developed at EML to continuously monitor the aerosols at DOE sites currently involved in environmental restoration.

**Gamma Spectrometry:** Gamma-ray spectrometry at EML is performed with high-resolution germanium detectors in five different configurations. Over the past year filter samples from EML's Surface Air Sampling Program (SASP) were routinely analyzed with germanium detectors for  $^7\text{Be}$ ,  $^{95}\text{Zr}$ ,  $^{137}\text{Cs}$ ,  $^{144}\text{Ce}$ , and  $^{210}\text{Pb}$ . In addition, QAP samples were analyzed for a variety of gamma-ray emitters using these systems.

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**Instrument Design and Fabrication:** EML's engineering staff and its fully equipped and staffed machine shop creates the mechanical components required to support the design, fabrication, and deployment of environmental monitoring instrumentation. EML designs not only the radiation detection systems for environmental measurements, but also builds and maintains the electronic interfaces to these monitoring instruments.

**Neutron Spectrometry:** Over the past two decades, EML has performed hundreds of measurements of neutron energy spectra. Recent projects include multisphere neutron spectrometer measurements aboard NASA ER-2 aircraft as part of the Atmospheric Ionizing Radiation (AIR) project, aboard Canadian Forces aircraft, at the Princeton Tokamak Fusion Test Reactor (TFTR), and at the Army Pulse Radiation Facility in Maryland. Other components of this program include the calculation of response functions for multisphere neutron spectrometers and the development of deconvolution methods.

**Physical Modeling:** EML is utilizing a three-dimensional groundwater model to examine and predict the transport of uranium contamination at Fernald, Ohio for the Fernald Environmental Management Project (FEMP). Advanced graphical data visualization is used to analyze and display the complex three-dimensional model results and observations of the contamination surrounding Fernald.

**Program and Database Management:** EML's broad base of scientific disciplines allows its staff to provide DOE and other government agencies with critically required assistance for program management in areas such as Characterization, Monitoring, and Sensor Technology (CMST) and Joint Coordinating Committee on Environmental Management (JCCEM). EML maintains the most extensive and comprehensive environmental database in the world on the fate of nuclear debris resulting from atmospheric weapons tests. EML also maintains the Human Subjects Research Database that contains descriptions of all projects involving human subjects funded by the DOE, performed by DOE staff, or conducted at DOE facilities.

**Radiochemistry:** EML performs radiochemical analysis of low-level environmental samples, and develops and refines analytical methods, with a focus on waste reduction, lower detection limits, and faster turnaround time. EML collaborates with other national and international agencies, such as National Institute of Standards and Technology (NIST) and International Atomic Energy Agency (IAEA) in the area of QA/QC, training, and serving as a reference laboratory.

**Radiological Surveys:** Assessments of natural background, nuclear weapons test fallout, accidents, and former processing facilities require surveys to characterize the type and spatial variability of radiation and radioactivity and environmental sampling. Over the years, EML has specialized in the development and application of radiological survey methods and instrument systems to support these environmental assessments.

## ***1.4 Summary of Major Business Areas***

As a federal R&D laboratory, EML provides its customers with technical expertise in support of DOE programs, scientific and technical assistance, and data quality assurance for measurements of radiation and radioactivity relating to environmental restoration, global nuclear

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nonproliferation, and other priority issues for DOE and other government, national, and international organizations. EML's programs can be categorized into five major business areas:

- Quality Assurance (approximately 30% of EML business)
- Environmental Measurements (25%)
- Instrument Validation/Method Development (25%)
- National Security (15%)
- Emergency Response (5%).

In addition EML provides technical expertise to the CMST program and the Strategic Environmental Research and Development Program (SERDP). Some of EML's programs crosscut two or more of these business areas. For example, EML designed, developed, installed, and continues to maintain a worldwide network of aerosol and deposition sampling stations to document spatial and temporal trends in the distribution of artificial and naturally produced radionuclides in the atmosphere. The network rapidly identifies any new sources of radioactivity due to accidental releases or violations of the Comprehensive Nuclear Test Ban Treaty (CTBT). Elements of this program can be categorized in both the Environmental Measurements and the National Security business areas.

#### **1.4.1 Quality Assurance**

EML's Quality Assessment Program (QAP) is an external, independent performance evaluation program that supports the National Analytical Management Program (NAMP). The QAP is designed to test the quality of environmental radiological measurements reported by DOE contractor and subcontractor laboratories. The program provides its customers with complex-wide comparability of environmental radiological analyses for characterization, site survey and monitoring activities. Technical assistance is provided to QAP participants with deficiencies.

As part of the QAP, EML provides quality control materials for corrective actions, methods evaluation, and batch control as requested by the participating laboratories. Site-specific materials are developed in collaboration with DOE facilities.

While the QAP program was designed for environmental radiological investigations conducted in the U.S., it has attracted 32 international participants from 21 countries. The QAP can address the global need for assurance that environmental radiological information is compatible and of known quality. Ultimately, the program could provide laboratories with a basis of comparison for the global community of environmental radiological laboratories.

#### **1.4.2 Environmental Measurements**

EML's reputation for excellence in environmental measurements has led to its being called upon for assistance and consultation by numerous organizations in the U.S. and worldwide. EML has over 40 years of experience doing research on the measurement and characterization of environmental aerosols, radon and radon progeny, and the human health consequences of exposure to radon and radon progeny.

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EML maintains a worldwide network of aerosol and deposition sampling stations to document spatial and temporal trends in the distribution of artificial and naturally produced radionuclides in the atmosphere and to rapidly identify any new sources of activity due to accidental releases or violations of the CTBT. High volume air samples are collected weekly at 41 sites and mailed to EML for analysis. For a subset of these sites, the air filters are analyzed on site using the EML Remote Atmospheric Sampling Systems (RAMS); the data are transmitted by satellite back to EML. This allows near real-time measurements of short-lived radionuclides and rapid response capability for sites at remote locations where timely retrieval of samples is not practical. Radon concentrations in air are monitored continuously at two sites.

Because of its role as a federal measurements laboratory and its global network, EML maintains a unique and extensive archive of environmental samples such as soil, water, vegetation, and air filters. This record is now accessible over the Internet at EML's Web Site (<http://www.eml.doe.gov>). A "user-friendly" interface allows for sample searches using either a form or a map search. Over 50,000 unique samples are present in the archive.

EML also provides technical assistance at sites undergoing remediation where radiological surveys are required. General consultation and specific guidance and training are provided along with QA, including the performance of confirmation surveys. As a federal DOE laboratory, EML serves as a technical interface between DOE site personnel and the contractors who are engaged in survey programs. These efforts ensure that surveys are conducted with a high degree of quality in a cost-effective manner.

Increasingly, DOE is relying on measurements that can be performed directly in the field to support cleanup. EML is active in advancing the state-of-the-art for radioactivity measurements, particularly in in-situ gamma-ray spectrometry, a technique for assessing specific radionuclide concentrations. In place of potentially non-representative soil sampling techniques and time consuming laboratory analyses, in-situ spectrometry can provide a measurement of several tons of soil in a few minutes at the measurement site, providing savings in time, effort, and expense.

### **1.4.3 Instrument Validation/Method Development**

EML provides analytical instrument validation. Environmental applications require appropriate laboratory calibration of instruments including characterization of their energy and angular response. Field measurements may require treatment of complex conditions including hot spots, difficult terrain, and a naturally varying background radiation field. A program to check calibration and test performance under real field conditions addresses measurement QA needs, as well as establishes a means to efficiently evaluate new technology being developed.

EML administers the International Intercomparisons of Environmental Dosimeters program, initiated in 1974 to assess the performance of passive, integrating detectors in the measurement of environmental radiation and to identify and investigate special problems associated with such measurements. These voluntary intercomparisons are presently the only available large scale and universally recognized QA program for passive environmental dosimetry.

EML conducts studies that encompass occupational, residential, and ambient environmental settings, requiring methodologies of progressively increased sensitivity and detail. The Multi-



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Agency Radiological Survey and Site Investigation Manual (MARSSIM) has been developed jointly by representatives from DOE, the Environmental Protection Agency (EPA), the Nuclear Regulatory Commission (NRC) and the Department of Defense (DoD). MARSSIM provides guidance for planning, conducting, evaluating and documenting environmental radiological surveys for demonstrating compliance with dose-based regulations for decontamination and decommissioning of nuclear facilities. The MARSSIM describes standardized and consistent approaches to conducting radiation surveys and site investigations of potentially contaminated soils and buildings. EML assisted in MARSSIM development in the area of survey design, measurement methods, and statistical analysis for the interpretation of survey results.

EML has provided the technical basis to support the implementation of new decommissioning criteria. This included the development of the methodology to be employed in final status surveys. Guidance is provided in two NRC documents: "A Non-Parametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys" (NUREG-1505) and "Measurement Methods for Radiological Surveys in Support of New Decommissioning Criteria" (NUREG-1506). Demonstration surveys using these methodologies have taken place at a variety of NRC-licensed facilities.

For many projects, EML acts as an independent technical interface between DOE site personnel and contractors. Current remediation efforts at a variety of sites within the DOE complex require that radiological surveys be performed to characterize contamination, monitor the course of cleanup work, and demonstrate that release criteria have been met. EML, as a technical, non-contractor DOE presence, is required to insure that radiological surveys be conducted in a cost-effective manner and with a high degree of quality. In particular, problematic sites with special needs require that state-of-the-art survey methodology be applied, and that requisite expertise be available for addressing concerns of regulatory agencies on the adequacy of survey techniques. In addition to direct support to field sites, advances in radionuclide metrology for direct measurements in the field need to be continually pursued to increase efficiency of system-wide cleanup/certification operations.

#### **1.4.4 Emergency Response**

The IAEA invited EML to join its International Network of Analytical Laboratories (ALMERA). EML represents the U.S. in this consortium of expert laboratories that can be mobilized quickly to collect and analyze samples following a nuclear accident anywhere in the world. For example, EML analyzed samples collected in the atolls of Mururoa and Fangataufa in the French Polynesia for an IAEA study of the current and long-term radiological situation following French nuclear testing in 1996. The EML sampling networks provide the means to assess radioactivity releases on a global scale such as the 1999 criticality accident in Tokai-mura Japan. EML also serves as an advance team for the DOE Radiological Assistance Program to respond to nuclear emergencies in the northeast U.S.

#### **1.4.5 National Security**

As a federal facility, EML supports DOE's National Security mission through its detection and deterrence technologies. EML conducts research and development of field and laboratory-based advanced analytical instruments and technologies. Coupled with current techniques in sample

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collection, analysis, and data reduction, these technologies identify nuclear proliferation threats throughout the world. EML also provides advice and consultation on environmental measurements and signatures. EML is the U.S. radionuclide laboratory of the International Monitoring System for the CTBT organization.

EML provides DOE offices with a readily available and objective in-house capability to support their special and unique technical requirements. EML conducts authoritative and unbiased technical reviews, evaluations of proposals, and provides expert scientific consultation to various offices at Headquarters.

As federal technical experts, EML supports CMST activities as Project Facilitators and as the Focus Area Liaison for Deactivation and Decommissioning. EML contributes its technical expertise to Headquarters customers by assessing proposals, monitoring project progress, evaluating deliverables, and coordinating the technology implementation among the contractor, regulator and program office. In addition, EML is the Technical Program Manager for the Site Characterization and Contaminant Transport Focus Area of the JCCCEM collaboratively studying contaminant migration in groundwater with Russian and American scientists.

In November 1990, Public Law 101-510 was enacted establishing the Strategic Environmental Research and Development Program (SERDP) as a multi-agency program funded through DoD. The Program identifies, develops, and transitions environmental technologies that relate directly to defense mission accomplishments. SERDP addresses the environmental requirements of DoD and those requirements that are common across DOE and DoD. As DOE Technical Coordinator, EML has managed the day-to-day operation of SERDP for DOE since 1996.

Activities in the day-to-day operation of SERDP include:

- Developing the statements of needs related to DOE/DoD mission for projects funded by SERDP
- Reviewing and selecting proposals
- Reviewing SERDP new-start and continuing research projects
- Interacting with scientists and research coordinators from DOE Operations Offices and National Laboratories
- Coordinating the DOE Technical Thrust Area Working Groups (TTAWGs)
- Preparing and delivering briefings on SERDP activities to DOE Senior and Program Managers in HQ and the field
- Preparing official correspondence
- Coordinating activities related to the Annual SERDP symposium and In-Progress Reviews.

## **1.5 Customers/Funding Sources**

EML serves a broad range of federal customers, primarily in DOE, but also across agencies that require applied research and operational capability in environmental measurement, QA, and environmental applied research. EML's primary near-term strategy for fulfilling its mission and for increasing customer satisfaction and innovation will be to continue to meet the needs of its current customers, while also pursuing new customers. Its current federal customers include:

- DOE Office of Environmental Management (EM)
- DOE Office of Science (SC)
- DOE Office of Nonproliferation and National Security (NN)
- Work for Others (WFO) - Air Force (USAF), Defense Threat Reduction Agency (DTRA), Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC).

A summary of EML's prime functions or business lines and the customers who receive them is shown in Figure 2.

Business Lines	Customers			
	EM	SC	NN	WFO
QA	+	+	+	+
Environmental Measurements	+	+	+	+
Instrument Validation/ Method Development	+		+	+
Emergency Response			+	+
National Security			+	+
HQ Program Coordination	+	+		

**Figure 2. EML Business Lines and Customers.**

EML supports EM by:

- Acting as a federal technical lead
- Providing performance testing
- Supporting field surveys.

EML provides technical program management and expert technical support for CMST activities. EML contributes its technical expertise by assessing proposals; monitoring project progress; evaluating project products; and assessing technology requirements, capabilities and limitations.

EM provides funding for EML's QAP program, an external, independent performance evaluation program designed to test the quality of environmental radiological measurements reported by DOE contractor and subcontractor laboratories. The program provides EM with complex-wide comparability of environmental radiological analyses for site survey and monitoring activities. DOE laboratories and contractors supporting Site Environmental Surveillance are participants in the EML QAP as required by DOE Order 414.1.

EML serves as the Deactivation and Decommissioning (D&D) Liaison for CMST and participates in evaluation of basic science projects that may address the applied needs of the program. Radiological surveys are a fundamental component of restoration work. Building materials and soils must be characterized for contamination, monitored as cleanup work progresses, and then certified for release. With its long history in environmental radiation and

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radioactivity measurements, EML is applying its expertise in a number of areas directly related to these D&D activities.

EML supports EM in planning and conducting surveys to characterize radioactive contamination and to certify that release criteria have been met. EML serves as the technical interface between DOE site personnel and the Management and Operations (M&O) contractors engaged in survey programs. EML specializes in calibration facilities for environmental radiation and radioactivity measuring instruments for EM site cleanup including:

- Beam and panoramic irradiators for thermoluminescent detectors (TLDs)
- Calibration bench providing a precise geometry for shadow shielding and angular response measurements of pressurized ionization chambers (PICs), and for energy and angular response measurements of in-situ germanium detectors
- Environmental chamber for testing air samplers
- Low background vault for testing detectors and storing dosimeters.

As a federal R&D laboratory, EML provides other DOE program offices with a readily available and objective in-house capability in support of their special and unique requirements. EML conducts authoritative and unbiased reviews and evaluations of proposals and provides expert consultation for SC, NN and the Office of Environment, Safety, and Health (EH).

For SC, EML is responsible for establishing, annually updating, maintaining and ensuring the quality of a database of all human subject research currently funded by DOE. In addition, EML manages the day-to-day operation of the SERDP, a partnership program (DoD, DOE, and EPA) that addresses the defense-related environmental priorities focusing on cleanup, compliance, conservation, and pollution prevention technologies.

NN provides EML funding for research and development of field- and laboratory-based advanced analytical instruments and technologies, coupled with current techniques in sample collection and analysis and data reduction, to identify nuclear proliferation threats throughout the world and for advice and consultation on environmental measurements and signatures.

As partially supported by NN, EML operates and maintains a global sampling network of more than 140 sampling sites dispersed throughout the world. The EML network quickly tracks and communicates findings on any new introduction of radioactivity into the environment anywhere in the world.

## **1.6 Facilities**

EML resides in a General Services Administration (GSA) building in lower Manhattan, New York, occupying over 51,000 square feet of laboratory, office, and storage space. The unique, custom, and special facilities at EML include:

- Chemistry Laboratories
- Environmental Chamber
- Neutron and gamma ray calibration facility
- PICs for radon measurements

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- TLD Reader Facility
  - Electronics assembly and test area
  - Machine shop
  - Sample Preparation Facilities.

The Laboratory also operates the “EML Field Performance Testing Area” at Brookhaven National Laboratory (BNL), 70 miles to the east in Suffolk County on Long Island. Because of many ongoing cooperative projects with BNL, EML maintains an office and equipment staging area at BNL.

### **1.7 Summary of Significant Accomplishments**

EML continues to be a technical resource for environmental measurements and data quality. Listed below are examples of EML’s FY99 achievements:

- The Multi-Agency Radiological Survey and Site Investigation Manual (MARSSIM) Work Group, of which an EML scientist is a member, received the Hammer Award of Vice-President Gore’s National Partnership for Reinventing Government
- EML received a Certificate of Excellence from the Air Force Technical Applications Center (AFTAC) for its contribution to the AFTAC Materials Product Team whose efforts led to AFTAC receiving the National Defense Meritorious Unit Citation
- EML scientist was awarded the American Society for Testing and Materials (ASTM) committee’s highest honor, the “Max Hecht Award” for outstanding service and leadership as the Chair of Subcommittee D19.04 for Radiochemical Analysis for Water and Water Deposits which addresses low-level radiochemical methodologies
- EML has been selected by the U. S. Delegation to the Preparatory Commission for the CTBT Organization, Vienna, Austria, as the U. S. radionuclide laboratory to be incorporated into the International Monitoring System (IMS). There are 16 IMS laboratories worldwide, and they provide confirmatory analyses of atmospheric radionuclides and quality control functions for the 80 radionuclide IMS sampling sites
- EML represented the Office of Science and Technology (OST) on a team for an EM Review of the Idaho Operable Unit-7 (OU7), Staged Interim Action Project (also known as Alternate Pit 9, 30% design completion). The purpose of the review was to assure that the project has a sound technical, cost and schedule basis and has a high probability of meeting its regulatory milestones
- EML headed the U.S. Delegation of a joint American/Russian Workshop to discuss the characterization and modeling of subsurface migration of the groundwater plumes
- EML’s work at FEMP has resulted in the major accomplishment of EPA approval for the use of real-time instrumentation for pre-certification purposes. This has significant cost and schedule implications and is precedent setting for other DOE sites. Real-time measurements are projected to save over \$30 million in measurement costs and will allow the 2006 closure schedule to proceed without delays due to analytical overload

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- EML is assisting in the refinement of the current FEMP groundwater model for achieving capture and cleanup of the FEMP's groundwater plumes by employing the minimum number of conventional extraction wells necessary within a reasonable time frame for restoring the aquifer. This activity supports the accelerated groundwater cleanup of a sole source drinking water aquifer. The Lab will continue to support the FEMP with technical guidance on the application of this technology to new types of measurement needs at the site
  - EML partnered with BNL on an Accelerated Site Technology Deployment Program (ASTD) proposal supporting the EM Deactivation and Decommissioning Focus Area (DDFA). The proposal, "Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites" was approved for FY 1999-2000. The ASTD project involves the application of MARSSIM methodology for radiological surveys and in-situ spectrometry to support the stabilization and ultimate decommissioning of the Brookhaven Graphite Research Reactor (BGRR)
  - With its experience in measuring radionuclides in lake sediments, EML is providing consultation to BNL on background concentrations, sampling, analysis, and QA related to the highly sensitive issue of plutonium and other radionuclide levels in sediments along the Peconic River, New York
  - EML is providing measurement support and guidance in development of plans for the characterization and radiation monitoring of the Area of Concern (AOC) 6 - Building 650 Sump Outfall Area of OU IV at BNL. This activity supports the BNL Environmental Restoration Division's (ERD) final remedial design for this OU. EML provided radiation monitoring and field and laboratory measurements of radionuclides in surface and sub-surface soils of the Building 650 Sump Outfall Area at BNL. Quarterly TLD environmental radiation monitoring at AOC 6 was made by EML as part of the interim remedy while BNL upgrades their in-house environmental monitoring program
  - EML is assisting the Princeton Plasma Physics Laboratory (PPPL) by providing quality oversight and analysis for a shipment of tritium waste from PPPL to the Hanford Site for disposal
  - EML has entered into an agreement with the West Valley Demonstration Project to provide technical document review and assistance in resolving questions on waste characterization and closure engineering report data
  - EML participated in the development and presentation of a MARSSIM training course produced by the Oak Ridge Institute for Science and Education Professional Training Program (ORISE PTP). This course is now required of NRC inspectors
  - Physicist at EML was named as Chair of Working Group ANSI N13.37, Standard for Thermoluminescent Dosimetry -Environmental Applications. The working group includes experts in the field from government agencies (DOE/EH, NRC, NIST), National Laboratories (Pacific Northwest National Laboratories [PNNL]), universities and industry
  - EML instituted a new QAP data entry system through the Internet and also upgraded the search capabilities on the results of the current distributions. The QAP data results, as well as QAP reports, are available through the QAP Home Page (<http://www.eml.doe.gov/QAP>)

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- Three new methods were added to EML's Procedures Manual: "Preparation of Microprecipitation Sources for Reanalysis," Proc. G-04; "Iron in Aqueous Samples - Dual-DP Mode Liquid Scintillation Analysis," Proc. Fe-01-RC; and "Technetium-99 in Water - TEVA Resin," Proc. TC-02-RC
  - EML continued its significant participation in the Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual Work Group activities. MARLAP is an interagency group with representatives from DOD, DOE, EPA, U. S. Food and Drug Administration (FDA), NIST, NRC and USGS who are developing a joint federal guidance manual for planning, implementation and assessment of projects which require radioanalytical analyses
  - The FY98 update of the Human Subjects Research Database (HSRD) was released through the World Wide Web ([http://www.er.doe.gov/production/ober/ober\\_top.html](http://www.er.doe.gov/production/ober/ober_top.html)). The FY98 database profiles 258 research projects at 35 research facilities and includes a variety of activities ranging from actual experimentation to simple questionnaires
  - EML worked with the National Science Foundation (NSF) and other federal agencies to produce the "Draft U.S. Arctic Research Plan Biennial Revision: 2000-2004," and provided the Department's contribution to the plan
  - EML has developed databases for its unique archives of environmental samples associated with its research programs, some of which were collected over 40 years ago. Many of these historic samples, collected during the period of atmospheric nuclear weapons testing, have unique isotopic compositions, and, therefore, can be used to test and evaluate instruments developed by the NN-20 community and others. In addition, the samples can be used for geolocation in forensic nuclear analyses, for identification of environmental signatures of nuclear activities, and to establish current baseline values for selected environmental signatures. In FY98, databases existed for surface air filters and deposition samples
  - Scientists and engineers from EML, Los Alamos Neutron Science Center (LANSCE), and the NASA Langley Research Center performed an experiment at the Weapons Neutron Research Facility of LANSCE. The experiment measured the response high-energy multisphere neutron spectrometer to a known spectrum of high-energy neutrons. The EML spectrometer, flown last year on a NASA ER-2 aircraft to characterize cosmic radiation and determine doses to aircraft occupants at high altitudes, is the primary instrument of the AIR Measurements Project. The measurements at LANSCE are necessary to verify the response of the spectrometer at neutron energies where calculations of the response have large uncertainties.

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## **2 Status Report**

### **2.1 Management Oversight**

#### **2.1.1 Program Management**

EML's Annual Business Plan establishes the near-term strategies and tactics that will help EML employees and stakeholders move the organization toward fulfilling its mission. Its purpose is to communicate to:

- EML employees and stakeholders -- EML's business environment, key goals, and performance measures for FY99 and into FY00
- DOE CH -- EML's plans and strategies so CH can advise, track progress against EML goals, and provide support for EML's plans
- DOE EM -- EML's efforts to identify opportunities where EML can contribute to EM's environmental cleanup mission and to ensure EML is providing strong stewardship for EM
- DOE's technical community -- EML is a federal resource for providing data quality assurance and non-routine, state-of-the-art field and laboratory analyses, and for measuring radiation, radioactivity and other energy-related contaminants in the environment.

The plan evaluates EML's current situation (market assessment), external business and societal trends, and EML's primary competitors. It addresses continuous improvement processes (primary strategies and performance metrics) and outlines EML rewards plan. It provides a financial summary and projections, as well as recent EML accomplishments and activities. EML conducts annual strategic planning retreats to review the previous year's Business Plan and plan strategies and performance metrics for outyears.

The respective Divisions or designated EML teams implement EML's plan. In addition, cross-functional teams spanning the divisions perform much of the project and applied research work. At regular senior staff meetings, EML management reviews budget, schedules, and technical progress. EML management provides resources, monitors progress, ensures quality, and ensures fiscal responsibility on WFO programs.

Scientific briefings are held monthly with senior staff, wherein the technical progress of a specific scientific division is presented and issues are discussed (e.g., resource needs from another division). Ad-hoc meetings (team and workgroup) and other communications occur regularly to execute scientific and administration work (local staff handles most activities, e.g., contracting, payroll, Environment, Safety, and Health [ES&H], Nuclear Materials Accountability and Control [NMA&C], purchasing, Safeguards and Security [S&S], QA, computing).

#### **2.1.2 Budget and Accounting**

EML receives its funding for salaries and other activities through a program direction account. EML management leads activities funded from this account, such as determining what projects to conduct, and the scope, schedule, and quality. EM and EML informally negotiated an agreement in 1997 that EM work at or for sites would be charged at 50% of full cost to balance the presence



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of program direction account funding with the need for additional funding to conduct work for these clients. This agreement was never formalized and costs of EM work are established case-by-case.

WFO are projects funded based on proposals or other marketing activities. Work for other DOE research program offices and WFO are invoiced at 100% of actual costs determined according to originating agency requirements. This unusual accounting procedure is legal and has been reviewed and approved by DOE's financial management chain; however, it can be confusing to sponsors, management, or casual observers.

### **2.1.3 Management/Technical Reviews**

In early FY98, EML conducted an internal organizational self-assessment and senior staff retreat to address management and operational issues that can lead to better performance and higher levels of customer satisfaction. The self-assessment is part of a CH initiative to use the national quality award criteria in improving performance.

External project reviews are held at the discretion of agency or headquarters management. An EM point of contact with CH membership chairs the External Review Committee.

Internal project reviews are scheduled periodically. The goal is to review each major project annually. Reviews are structured according to a prescribed format by the principal investigator or team leader and are attended by technical management. Action items are generated and tracked.

Completed projects are reported in peer reviewed publications or EML reports. Internal technical and management reviews are conducted on all draft publications. An EML publication policy has been in effect since the mid 1980's. It identifies the forms of publications to which the policy applies, and gives procedures to be followed, internal reviews required, and mechanisms for publication. Publications are considered to be any formal communication, printed or electronic, that represents the Laboratory and that can be cited. Examples of EML publications that require going through EML's internal review are: peer reviewed journal articles, conference papers, books or monographs, DOE/EML or other government reports, and Procedure Manual (HASL-300) methods. The Publication Policy is revised as necessary to keep it current and effective. EML is working with its CSO (DOE-EM) to adapt its review process to the EM specific situation as needed.

EML has an active review program in Customer Service. The Assistant to the Director for Technical Program Coordination is the EML Customer Focus Advocate and participates in the CH Customer Service Initiative. The most important factors that generate satisfaction for EML's customers are:

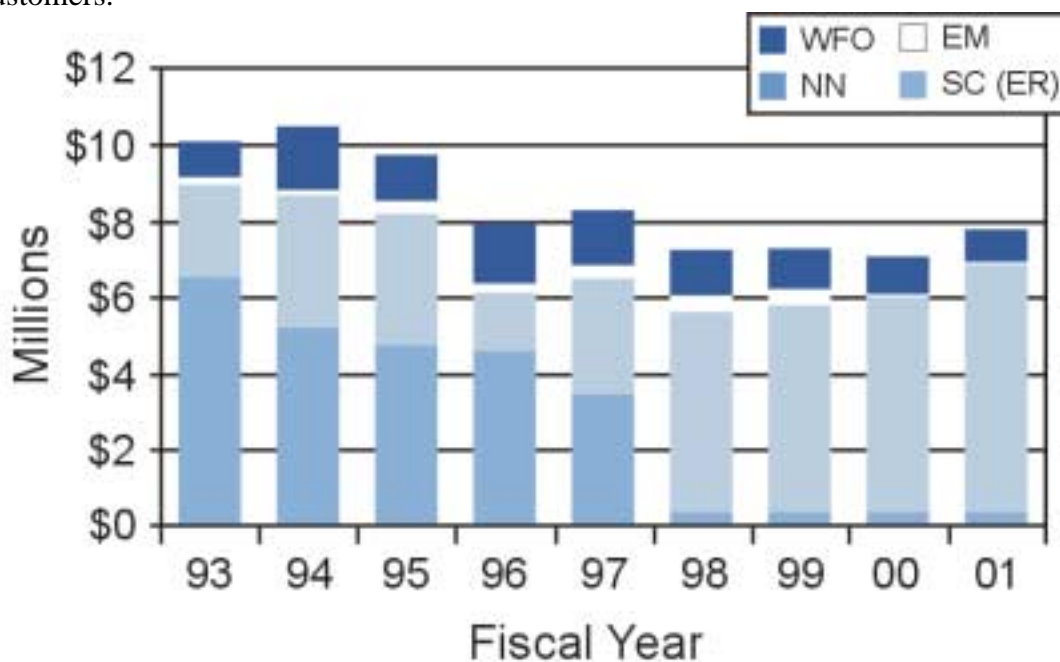
- Responsiveness
- Reliability
- Unbiased federal response in accordance with DOE policy
- High technical level of expertise.

In the three most recent customer surveys, EML's customers cited continuing exceptional performance of the EML staff and responsiveness of the staff to their needs. Customers acknowledged unique services and expertise provided by EML. In FY98, 100% of EML's customers responded as "very satisfied" or "satisfied" with working with EML. Several customers noted individuals for special recognition in the most recent survey results (September 1998).

## 2.2 Status of Customers/Funding

### 2.2.1 Major Customer Funding

The FY99 budget was \$7.550 million funded by DOE (EM, SC, NN) and WFO (AF, NRC, NASA). Figure 3 summarizes the historical, current and projected funding from EML's principal customers.



**Figure 3. EML Funding: 1993-2001.**

The FY00 Congressional Budget language indicated that:

*"EM's contribution to the EML in FY 2000 will be \$5,361,000. This level of funding will support the Federal work force of approximately 60 employees. However, the funding is not sufficient to support all of the administrative costs associated with the Laboratory. Work for others, such as (NN, SC, USAF, NRC) and other federal agencies will generate additional funding to be used for programmatic and administrative expenses incurred by this laboratory."*

As shown in Figure 3, EML has experienced a significant reduction in SC funding in the past and will experience an additional reduction (\$290K) in funding from NN in FY00. This decrease is partially offset by an increase in funding from EM; however, these funding issues make it

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difficult to support important programs without reprogramming. A more detailed financial summary and projections for FY00-01 are shown in Appendix A in EML's 2000 Business Plan.

As indicated in the Congressional language, there are no targeted funds for administrative activities (payroll, ISM and QA, NMA&C, purchasing, safeguards and security, computing) at EML. In addition, capital equipment, facilities maintenance, and support contracting costs are not covered in the basic budget.

### **2.2.2 Work for Others and Service to Other DOE Offices**

Since EML's environmental expertise is recognized throughout the world, it is called upon by other organizations to provide technical consultations and services or perform specialized studies to address topical issues. Insofar as it is within the best interests of the Department and within the scope of the Laboratory's mission, EML enters into formal contracts and agreements with other government agencies and international groups to work together on projects. Where appropriate, funding for travel, equipment, and facilities support is provided to EML by these groups to cover expenses. EML's WFO represents a cost effective way to bring unique knowledge and experience to organizations dealing with challenging problems in environmental radiation and radioactivity having national impact. WFO projects of this nature are a natural extension of the staff's collective expertise and are in keeping with a larger role that a specialized laboratory such as EML plays within DOE. EML's WFO customers include the USAF, DTRA, EPA, and NRC, who gain from EML's unique strengths in monitoring, sampling QA, and measurement innovations that meet various needs in their individual organizations. Examples of WFO activities include:

- The USAF provides funding to EML for the development, deployment, and maintenance of monitoring instrumentation and for radiochemical analyses to support verification programs under the CTBT
- EML, under contract to the NRC, developed new radiological survey designs and measurement methods for residual radioactivity that will be used to meet rulemaking decommissioning criteria and clearance issues
- The DTRA is funding EML to be the U.S. Radionuclide Laboratory for the CTBT. Related to this, the USAF is providing funding to EML for the development of monitoring instrumentation to support verification programs under the CTBT
- EML scientists are invited by the scientific community to participate in consultations and reviews of programs, proposals, reports and other documents. EML has played a major role in the development of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), a cutting-edge effort to rationalize the characterization and sampling requirements across agencies. Originally funded by the NRC, EML now receives funding for MARSSIM through the EPA's National Environmental Training Office (NETO) to provide training to regulators, site personnel, and stakeholders
- EML scientists provide radiation and radioactivity measurements training courses to federal and state agencies and to international institutes.
- As a federal resource laboratory, EML provides DOE offices with a readily available and objective in-house capability in support of their special and unique requirements. EML conducts authoritative and unbiased reviews and evaluations of proposals and provides expert consultation for SC, EH, and NN.

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## SC

- EML is responsible for creating, annually updating, maintaining and ensuring the quality of the database of all human subjects research currently funded by DOE
- EML manages the day-to-day operation of the SERDP, a DoD, DOE, and EPA partnership program that addresses the defense-related environmental priorities focusing on cleanup, compliance, conservation and pollution prevention technologies.

## NN

- NN provides funding for research and development of field and laboratory based advanced analytical instruments and technologies, coupled with current techniques in sample collection and analysis and data reduction, to identify nuclear proliferation threats throughout the world, and for advice and consultation on environmental measurements and signatures
- EML operates and maintains a global sampling network of more than 140 sampling sites dispersed throughout the world. The EML network is continuously poised to track and communicate findings on any new introduction of radioactivity into the environment anywhere in the world due to the planned, clandestine or accidental detonation of a nuclear weapon, a nuclear reactor accident, a nuclear processing plant accident, a transportation accident involving nuclear materials, or a space satellite accident during a launch or atmospheric reentry involving a nuclear reactor or radioisotopic power source.

### 2.2.3 Partnerships and Collaborations

EML maintains professional working relationships with a broad number of organizations. The laboratory interacts with Surface Air Sampling Program (SASP) site researchers/technicians at the 41 SASP sampling sites throughout the year. EML works with the QAP laboratories and the laboratories that participate in the other EML QA activities. It collaborates with various universities, DOE laboratories, and international agencies, and the private sector as the need arises in environmental radiation and radioactivity, and QA in sampling and measurements and analyses.

EML hosts visiting scientists for periods of a few days to a few months. Training programs and scientific areas focus on radionuclide separation and measurement techniques, environmental sample analysis methods and data processing, and soil modeling for radon surface flux calculations.

EML currently has ongoing work with BNL, West Valley, FEMP, and PPPL. EML participated in development and presentation of a MARSSIM training course produced by the ORISE PTP.

### 2.2.4 Technology Transfer and Deployment of Technology

In FY98 and FY99, EML participated in the Accelerated Site Technology Deployment Program (ASTD) program, which supports deployment of EM-developed technologies. Figure 4 summarizes EML's contribution to technology transfer activities in 1999.

	Number of Environmental Remediation Technologies		
	Developed	Demonstrated	Deployed
<b>DOE EM</b>	3	1	3
<b>Other DOE</b>	1	0	0
<b>WFO</b>	1	2	0
<b>TOTAL</b>	5	3	3

**Figure 4. EML's Technology Transfer and Technology Deployment Activities in 1999.**

In FY00, EML will continue its activities under ASTD with the FEMP and BNL under the ASTD proposal: "Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites." In the area of technology development, the Portable Aerosol Sampling System (PASS) will be deployed at Fernald and the Tagged Aerosol Generator (TAG) will move into beta testing and demonstration.

EML intellectual property and technology designs have historically been viewed as public property and most of EML's technologies have not been protected through patents. Given recent changes in the laws and increased emphasis on intellectual property, EML is pursuing patents on two EML-developed technologies (AUTORAMP and the Radometer) and is investigating other patents on forthcoming technologies and computer software.

As a federal technical lead, EML supports EM's site closure and cleanup completions through its: (1) activities in development and deployment of radiological field characterization and monitoring technologies, and (2) performance testing programs which provide external oversight of quality of data used in cleanup activities. Accomplishments for FY99 were:

- Development and demonstration of PASS, a portable aerosol sampling system
- Demonstration and deployment of in-situ gamma-ray spectrometry
- EML Field Survey Team continued as a critical technical interface between DOE site personnel and contractors engaged in site surveys.

EML site survey activities could lead to a regulatory agency approved protocol that could significantly reduce remedial costs and accelerate schedules. For example, EML's real-time measurements at Fernald are projected to save over \$30 million in measurement costs and will allow the FY 2006 Closure Schedule to proceed without delays due to analytical overload.

One of EML's performance measures assesses results of EML's activities in technology development. Shown in Figure 4 are the FY99 metrics, using OST's breakdown of development, demonstration and deployment.

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## 2.2.5 Privatization

Since 1956, there have been occasional discussions concerning the privatization of EML. Informal and formal studies have consistently concluded that there is no advantage to privatization. DOE's Laboratory Operations Board (LOB) commissioned a study in 1998 to evaluate the cost-effectiveness of moving EML to Brookhaven. The study has been completed, but the report has not been released. The results of the study were sufficiently conclusive that Secretary Richardson decided in February, 1999 to keep the laboratory in Manhattan.

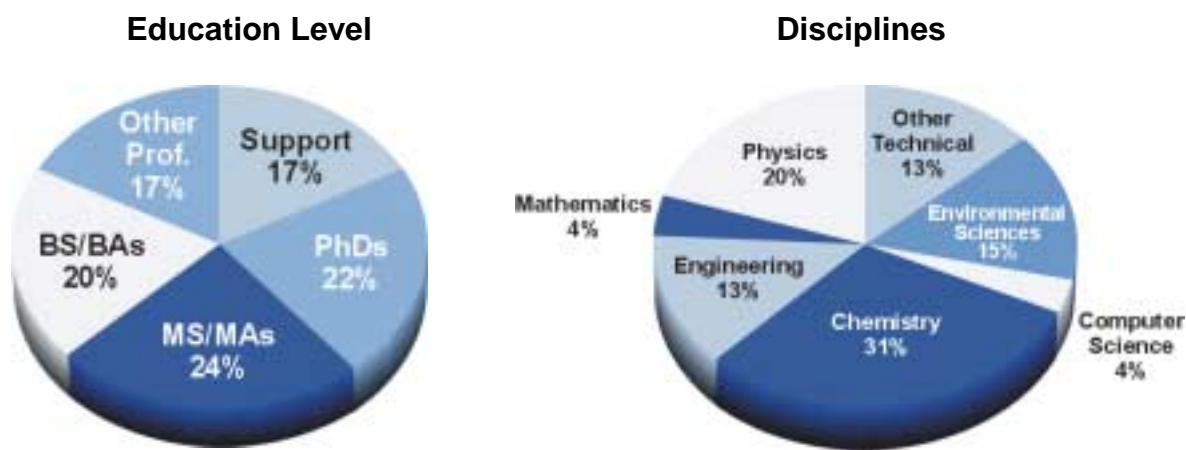
## 2.3 Status of Staffing

### 2.3.1 Demographics

EML has a current federal employee ceiling of 66 full-time equivalents (FTEs); actual on board FTEs total 60. These FTEs are assigned to EML through CH. The scientific staff is composed of chemists, physicists, geologists, engineers, computer specialists, an ecologist, and technicians. Laboratory scientists, engineers, technicians and support staff offer a team-oriented approach that brings a unique federal perspective and capability to meet national needs. Figure 5 depicts the skill mix and the educational levels of exempt employees.

As federal technical experts, EML staff are invited to participate and serve on national and international committees such as:

- U.S. Transuranium and Uranium Registries Advisory Committee (DOE Representative)
- Chapter Writing Groups of Multi-Agency Radiation Laboratory Protocols Manual (MARLAP) (Chair)
- Radionuclide Workshop, International Monitoring System Network, (provides scientific recommendations to Working Group B of the CTBT Organization) (Member)
- Working Group ANSI N13.37, Standard for Thermoluminescent Dosimetry--Environmental Applications (Chair).



**Figure 5. Staffing Profile for EML.**

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EML staff members serve as Adjunct Lecturers and Professors at New York University, Polytechnic University, Harvard University School of Public Health, Rutgers University, City University of New York, and The Cooper Union. EML personnel function as journal editors and reviewers and have been elected fellows of professional organizations.

### **2.3.2 Staffing Needs**

Several key vacancies exist at EML. EML anticipates that a staffing level of 66 is reasonable for the near-term as key positions are filled. Depending on attrition and FY00 and outyear funding, EML expects to continue to add staff to ensure it maintains highly qualified staff in core competencies.

EML uses a staffing analysis process to determine its resource needs. EML and CH management assesses staffing needs based on funding and Work for Others projections for the outyear. Staff profiles are compared to projected needs and positions matched accordingly. Resource gaps are identified and realignment and retraining is considered.

### **2.3.3 Labor Relations**

EML is supported by the American Federation of Government Employees Local 2828. Union and Management work together cooperatively. The Joint Labor-Management Committee serves as a partnership forum. In accordance with the Agreement between EML and the American Federation of Government Employees, Local 2828 (AFL-CIO), this committee serves as a forum for discussions on personnel policies, practices, and working conditions.

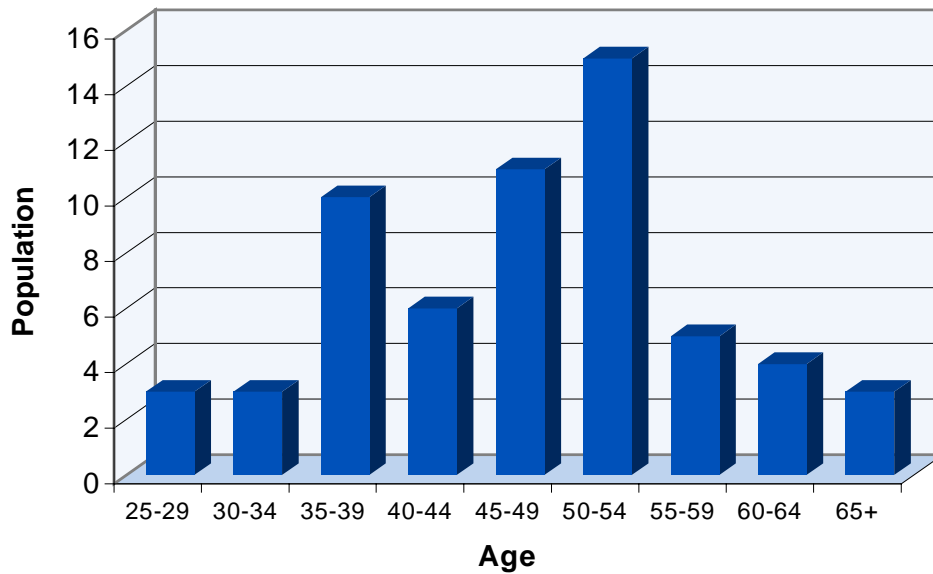
### **2.3.4 Other Workforce Issues**

EML, as other organizations throughout DOE, is concerned over loss of technically qualified people through retirement and attrition. Figure 6 shows the age distribution of employees at EML. An analysis shows that 21% of the scientific staff will be eligible to retire in the next 5 years. In addition, it is becoming increasingly difficult to recruit highly qualified or even apprentice scientists in some of EML's areas of expertise. This problem will become worse as universities discontinue programs that supported Cold War R&D.

## **2.4 Operations Oversight**

### **2.4.1 Capital Equipment**

EML has requested \$500K in the FY01 budget for capital equipment. As indicated in Figure 7, EML has had no funding for equipment since 1996. To maintain its reputation as a high quality laboratory, EML requires state-of-the-art equipment to continue doing high quality work for its customers. Appendix B contains a prioritized list of capital equipment needs.

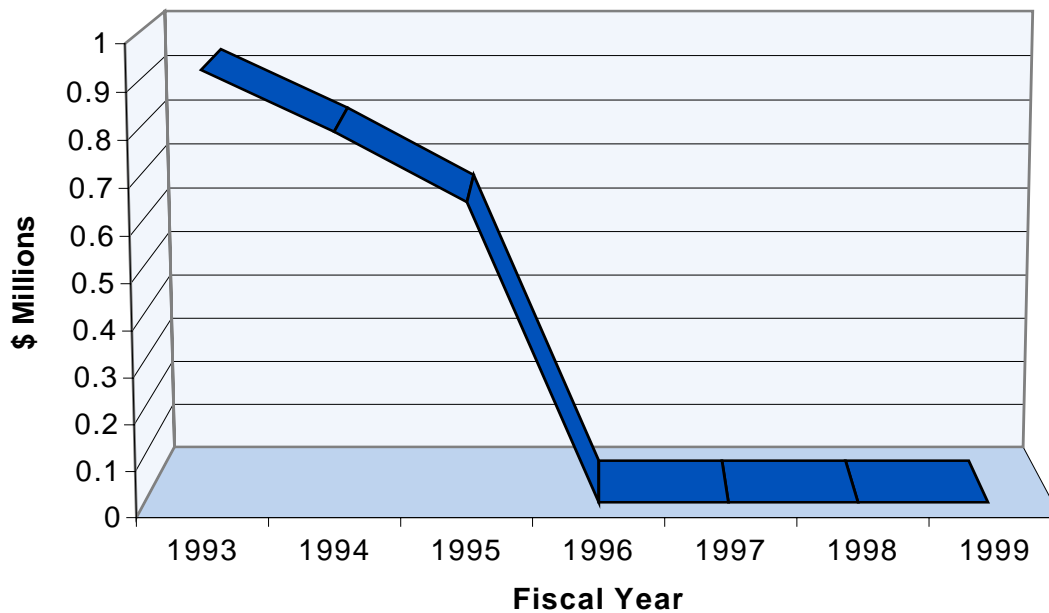


**Figure 6. Age Distribution of EML Employees (1999 data).**

#### **2.4.2 Infrastructure and Facility Maintenance/Needs**

EML rents space on one floor of a GSA-owned building. The laboratory also has space on the ground floor for a sample preparation laboratory, receiving, storage space in the basement and space for monitoring equipment on the roof. GSA is responsible for upgrades, construction, and infrastructure maintenance (water, gas, electric, HVAC, walls, etc.).

Within the laboratory, the facilities in Figure 8 have been part of EML since moving to the building in 1959. They are upgraded periodically. All upgrades are coordinated through GSA. EML is responsible for scientific equipment.



**Figure 7. EML Capital Equipment Funding: 1993-1999.**



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Facility	Last Upgrade	Status
Chemistry Laboratories	1992	needs upgrade to exhaust hoods, electricity, work space
Measurement Instrumentation Fac.	1994	needs electronics upgrades
Environmental Chamber	1994	needs upgrade to computer controls
TLD Reader Facility	1998	upgrade is on going
Calibration Facility	1996	upgrade is ongoing
Electron Microscope Facility	1990	needs upgrades
Machine Shop	1990	no planned improvements
Sample Preparation Facilities	1992	no planned improvements

**Figure 8. EML Facility Status.**

### **2.4.3 Environment, Safety and Health (including Integrated Safety Management)**

It has been and will remain the DOE/EML Policy on Environment, Safety and Health (ES&H) that the safety of its workers, respect for the environment, and the public health are paramount to the safe completion of DOE's mission. The policy strives for the highest degree of protection for employees, contractors, visitors, the public, and the environment and is achieved by implementing the principles of Integrated Safety Management (ISM).

The fundamental premise of ISM is that all accidents are preventable through close attention to work planning. Planning is accomplished by work design and hazard control, with substantial worker involvement in teams that plan work and select appropriate safety standards. The work is then performed using adequately trained personnel. An assessment of how well the system worked and feedback of evaluation results is done to reinforce and improve the process.

The ISM policy is also implemented by management's commitment to a work environment that allows free expression of safety concerns, and where workers fear no reprisals or retaliation. Workers are the most important resource for preventing and reporting hazards and potentially unsafe practices. EML management is committed that safety issues are promptly and objectively addressed. The ISM Policy is implemented at EML by the ISM Description.

This ISM Description specifies how EML integrates ES&H including pollution control and waste minimization requirements into the work planning and execution of the laboratories mission and goals. The Integrated Safety Management System (ISMS) incorporates worker, public and environmental protection considerations in all activities at EML. The ISM Description supports the DOE's fundamental goal to "Do work safely and protect human health and the environment."

### **2.4.4 Quality Assurance**

As a laboratory making a variety of measurements and developing precision instruments, QA is fundamental to EML's core business. Since the inception of the Lab, QA has been incorporated into technical and administrative work processes. In recent years, EML's QA activities have

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been captured in the Institutional Quality Assurance Plan (IQAP) and managed by a part-time QA officer reporting to the Laboratory Director.

The IQAP was updated and reissued in January 1999 and a new Laboratory Quality Assurance Officer (LQAO) was appointed in July 1999. QA Project Plans are currently being updated to comply with DOE O 414.1 “Quality Assurance” (1998) using the standards:

- ANSI/ASQC E4, “American National Standard – Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs” (1994)
- EPA QA/R-5 “EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations” (1998)
- DOE G 414.1-2 “Quality Assurance Management System Guide for use with 10 CFR 830.120 and DOE O 414.1” (1999).

EML provides QA services to DOE through several programs described elsewhere in the document.

#### **2.4.5 Security**

Responsibility for security planning at EML lies with the Security Manager, Administrative Division Director, and the Laboratory Director. Any activity affecting or related to classified matters must have the Director's prior approval. The Security Manager, in collaboration with the staff of CH Safeguards and Security Division as appropriate, using current threat guidance, the EML Safeguards and Security Plan, and results of appraisals, audits, etc., recommends to the Director, internal policy, operating procedures, hardware, software, or facility modifications necessary to improve the security program at EML.

The CH Safeguards and Security Services conducted an Integrated Safeguards and Security Inspection of EML, June 29-July 1, 1999. The inspection included a review and evaluation of the Laboratory's safeguards and security program. Topical areas addressed were program management, protection program operations, NMC&A, information security, and personnel security. There were no adverse findings as a result of this inspection and the rating was satisfactory.

#### **2.4.6 Information Management**

Information management systems are up to date. EML obtained exemption from Independent Verification and Validation (IV&V).

#### **2.4.7 Community Relations/Communications**

EML seeks to improve its services through continual outreach and communication. EML participates on the Energy Council for Community Service. Staff from EML give talks at local universities and attend community roundtable meetings. EML also provides tours of the laboratory to students from local schools.

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To maintain effective communications with management, EML staff also contributes to CH's Continuous Improvement Council (CIC) and Management Council.

In addition, EML provides:

- Weekly highlights
- Publications in peer-reviewed literature
- EML Reports -- technical accomplishments
- Annual Business Plan
- Quarterly assessment of progress against the business plan
- Brochure with overview of EML (revised in 1998)
- Fact Sheets (paper and web site)
- Annual Accomplishments Report
- Mid-year status report for CH review by EM management
- Vendor shows at technical conferences.

EML maintains an active Internet presence through its Web site ([www.eml.doe.gov](http://www.eml.doe.gov)).

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### **3 Appendices**

APPENDIX A. EML's FY 2000 Business Plan

APPENDIX B. EML's FY01 Capital Equipment Needs

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## APPENDIX A

### ENVIRONMENTAL MEASUREMENTS LABORATORY FY 2000 BUSINESS PLAN

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## APPENDIX B

### EML'S FY01 CAPITAL EQUIPMENT PRIORITIES

**Environmental Measurements Laboratory  
FY01 Capital Equipment Needs**

<b>CATEGORY</b>	<b>ITEMS</b>	<b>PROGRAMS</b>	<b>COST (\$K)</b>
Alpha Spectrometer	Multiple surface barrier detection system	QAP program, transuranic analyses to support site studies	30
Gross/Beta Measurements	Liquid scintillation counter	Sample screening and beta emitter analyses, radiation safety	40
Gamma Spectrometry	Solid state and scintillation detectors, pulse height analysis systems	QAP program, sample screening and measurement, <i>in situ</i> spectrometry deployment	70
Neutron Spectrometry	He-3 detectors, portable MCA/multiplexer; NIM electronics	Neutron radiation field ES&H, nonproliferation programs	30
Aerosol Measurements	Particle/hygroscopicity analyzers, high volume samplers	Support to sites for radon and air particulate measurements, global network monitors	165
Mass Spectrometry	ICP-MS system, flow injection system for ICP-MS, desolvator	Direct sample analysis for long-lived isotopes for QA and site studies	320
Analytical Chemistry	Balances, furnaces, flow injection unit, capillary electrophoresis system, microwave	QAP, national accreditation programs, sample analyses for site studies	85
Specialized Computing	Unix work station, high speed PC work station	Radiation transport calculations for detector responses and modeling for contaminant transport studies	35
Engineering	Nuclear instrumentation, electronic testing and machine shop equipment, engineering design software	Instrument fabrication, maintenance, and repair	30
Health Physics	Alpha, beta, gamma, neutron survey meters, detectors/data loggers	Laboratory radiation safety, nuclear materials accountability, site studies	10
General	Lab information management system, laboratory-wide PC and network upgrades	Project management, technical support, desktop computer and graphics needs	180
<b>TOTAL</b>			<b>995</b>